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An Interactive Communication Technology Adoption Model

In the evolving research arena of mediated communication technology adoption and uses, one of the most valuable developments involves the increased integration of distinct communication research traditions. This emerging fusion presents an unprecedented opportunity for communication researchers to share, confer, and challenge the "native" tradition that each has followed. This article proposes an integrated research model and explains how it can serve as the basis for mediated communication technology adoption research. In particular, this proposed model is intended to provide a research framework for studying the factors that help shape adoption decisions of various communication technologies and the potential impact of technology adoption on the social system, audiences, and use patterns.

Mediated communication, whether it be point-to-point or point-to-multipoint, stands as the backbone of an information society and a significant phenomenon in human communication. As pointed out by Qvortrup (1994, p. 377), information-technology tools should be regarded as "social tools" because they are utilized for the transfer, manipulation, storage, and retrieval of human symbols, cognitive products, and interactive relations. The significance of these social tools is most visible not only in terms of the amount of time they consume in human communication on a daily basis, but also in the level of scholarly research they help generate. The latter scenario is readily observable via the availability of a slew of peer-reviewed academic journals (e.g., *Journal of Computer Mediated-Communication, Journal of Electronic Publishing*, *Behaviour and Information Technology*, *The Information Society*, etc.) dedicated to mediated communication research.

Equally important is that other disciplines traditionally distinct from communication—such as library sciences, education, psychology, and information management sciences—have also published scholarly works and dedicated journals to addressing their unique perspectives on mediated communication research. Communication technology research, thus,

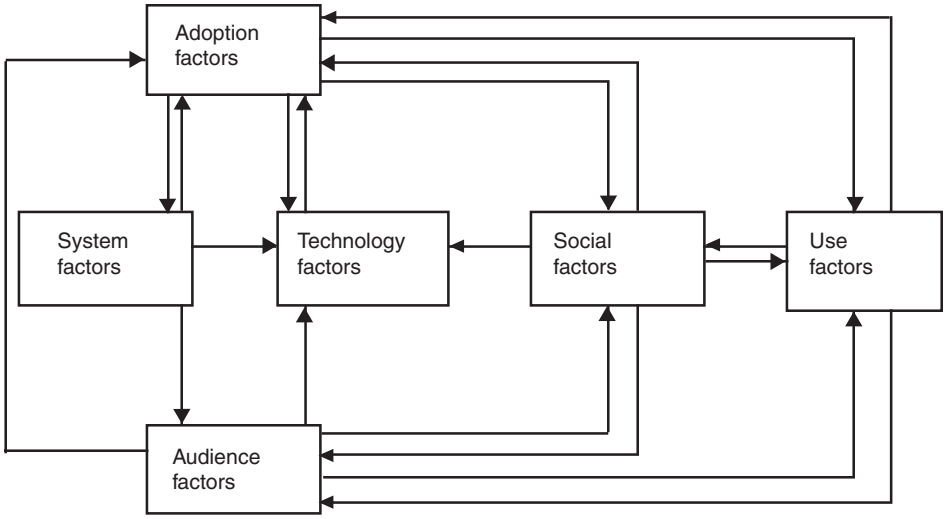

Figure 1. An interactive communication technology adoption model

is an important scholarly topic that provides a common ground for research in multiple academic disciplines, including communication.

In the evolving research arena of mediated communication technology adoption and uses in the communication discipline, one of the most valuable developments involves the increased integration of distinct communication research traditions. This emerging fusion exemplifies the crossroads at which we have arrived contemporaneously, presenting an unprecedented opportunity for communication researchers to share, confer, and challenge the "native" tradition that each has followed.

Communication as a human behavior occurs on a continuum within microsocial systems that is subsumed under a larger macrosocial system (e.g., Atkin, 2000). The analysis of these micro- and macrosystems can be informed by a research model built on the principle of dynamic interactivity, one that interconnects a number of reciprocal social, technological, and human communication factors.

This article proposes such a research model and explains how the integration of these different model components can serve as the basis for mediated communication technology adoption research. In particular, this proposed model intends to provide a research framework for studying the factors that help shape adoption decisions of various communication technologies and the potential impact of technology adoption on the social system, audiences, and use patterns. The model also seeks to propose a typology, one in which different components can be studied in various combinations, to examine the interactions within either a micro- or macroperspective or between a micro- and a macrocontext.

Table 1. Model Components & Theoretical Perspectives

Model component	Theories or constructs
System factors	Regulation/policy Technological culture Industry trends Market competition
Technology factors	Innovation attributes Social presence Media richness Technology fluidity
Audience factors	Innovative attributes Innovativeness need Self-efficacy Theory of reasoned action
Social factors	Opinion leadership Critical mass Media symbolism
Use factors	Uses and gratifications Expectancy value theory Communication flow
Adoption factors	Nonadoption Discontinuance Likely adoption Adoption Reinvention

Each component in this model can be further examined, in conceptual terms, through a proposed series of communication research perspectives. As shown in Table 1, although some of these research perspectives represent already established theories or constructs, others remain in a nascent state.

The following discussion illustrates the interrelationships between model components, starting with the "system" factor—the basis for technology development, marketing, and diffusion. This discussion ends with "use" factors, which are recursively connected to the system factor.

Components of Adoption Model

System Factors

The system factors concept is based on a systems theory that reflects an open system—including structural, social, and/or behavioral components—functioning between a morphostasis (structure-maintaining) and morphogenesis (structure-changing) state (Buckley, 1967). This system is dynamic and constantly changing, depending on the evolving input and output of matter and energy; it is constantly adapting to changes, in

order to achieve some form of balance (Anderson, Carter, & Lowe, 1999). In essence, this system can also be looked upon as a decentralized diffusion system in which system structures and innovation diffusion constantly interact with each other to generate changes that can also alter the power structures within the social system (Butler & Gibbons, 1999).

Hence, some components in this social system can "design" and "monitor" feedback, exerting influence to control changes in the system itself (Lundberg, 1980, p. 251). These components reflect the primary macrosocial forces that can either inhibit or facilitate the diffusion of communication technology innovations. Such forces include public and private institutional policies as well as the culture that both defines and integrates a communication technology into the system, helping catalyze political, economic, social, and cultural change. For example, Rice and Webster (2002) considered economic and industry standards and regulations, interoperability, and national culture as "external influences" that can impact adoption, diffusion, and use of new media. The diffusion of innovations thus evolves within the confines of a social system that carries out policies that advance or inhibit the diffusion goals through such social institutions as government bureaucracies (Rogers, 1995).

To wit, the social lexicon has expanded to include such buzzwords as information age, information technology, technocrat, techthusiasts, techies, IT workers, and computer-mediated communication. Fiske (1990) maintained that these linguistic technology referents—generated in marketing campaigns, trade or academic journals, news media, and the like—help construct the social meanings and the "public image" of technology diffusion. Hence, in addition to being marketed as a technical medium, a communication technology product also represents a distinct idea, attitude toward the world, image, social status, or lifestyle, as well as an affinity to a subculture, pledge of stake in the future, and so on. (Dahlberg, Livingstone, Moreley, & Silverstone, 1989). By virtue of cultural assimilation, then, communication technologies can symbolize "(sub)cultural identity, position, image, self-perception, and world picture, social status, property rights, user competence, performance, 'techno-cultural capital,' and so on" (Jensen, 1993, p. 310); such innovations also embody the symbolism of technological culture (Dahlberg et al., 1989).

Semiotic interpretations of technology as culture thus raise the question of the causal relationship between culture and a postmodern or information society. According to the "determined technology" perspective, the development and distribution of technology encompasses a set of system effects triggered by political, social, or economic factors. Bell (1973) cast these elements as a logical outgrowth of rational human will and control. This dialectic, often equated with the technology assess-

ment tradition, is constantly emerging and reformulating for the purposes of generating rational economic, social, and political forecasts.

As a dominant paradigm for technology development planning and forecasting, this technology assessment model is often applied via the gathering and analyses of facts to generate hypotheses and anticipated outcomes, based on the interaction effects of regulation/policy, industry trends, and market competition (Pepper, 1987). Lundberg (1980) noted that regulatory/policy decisions serve as a "control mechanism" that is intended for regulating or legislating the communication technology industry's production, market structure, and marketing practices. Systems controls of this sort exert a strong impact on the industry's research and development process, which directly determines the types of technology products produced and distributed.

Industry trends can also provide a form of systems control through their abilities to reciprocally help shape regulatory and policy trends that are guided by government bureaucracies. Such trends can also help deter the development or acceptance of a technology as the "next new rage" for the market by favoring certain types of technical platforms (e.g., integrating voice and video into instant messaging) or standards (e.g., deferring to a de facto for stereo AM transmission). Further, such examples include the rise of MPEG (i.e., Moving Picture Expert Group) standards for audiovisual information streaming and the widespread adoption of ADSL (i.e., asymmetrical digital subscriber line), which provides high-speed Internet or data communication through a digital modem over a regular phone line to circumvent the lack of a broadband network structure. Lansing and Bates (1992) noted that industry favoritism or bias of this type can effectively decelerate the growth and adoption of other types of emerging communication technology.

As the ultimate arbiter of the economic success or failure of a technology, market competition—a condition that ranges from "nonexistent" to "intense" as a result of system controls exerted by industry and government policies—can both shape and reshape industry trends as well as regulation. Perhaps the best example of government efforts to create market competition is the breakup of AT&T, which unleashed the vast market for telecommunication and information technology innovations (Bates, 2002). Intense private sector competition in the Internet service provider (ISP) market drove AOL and AT&T to establish a cable TV industry subsidiary for broadband service applications. Cross-industry consolidation that extends to vertical as well as horizontal integration at a massive scale, in turn, regenerates consideration of new regulation/policy debates.

In sum, system factors—designated as a combination of regulatory and policy tendencies and outcomes, technological culture in society,

industry trends toward developing specific technology platforms, and market competition—all can help construct or deconstruct the market infrastructure for technology diffusion. In particular, system factors influence what kinds of technology products, features, uses, and interconnections will be developed and marketed within the given regulatory and policy environment as well as social and market trends toward technology adoption and uses.

Audience Factors

Audience factors function within the parameters of system factors that dictate the availability and affordability of technology products to members of a society. In particular, the characteristics of one's social membership can help determine why, how, when, and which communication technology products may be adopted. Above and beyond one's social membership, audience factors can include (a) predisposed personality traits that make the audience receptive to the idea of innovation adoption (e.g., risk tolerance); (b) self-actualization need for adoption (e.g., for work or pleasure); (c) beliefs about one's ability to adopt and use a technology innovation with computers; and (d) beliefs and attitudes about the rationale for innovation adoption.

Representative personality traits that reflect individual innovative attributes might include such characteristics as venturesomeness (Foxall & Bhate, 1991), novelty seeking (Hirschman, 1989), and sensation seeking (e.g., Dupagne, 1999), as well as willingness to take risks (Feldman & Armstrong, 1975) and entertain new ideas (Midgley & Dowling, 1978). The validity and reliability of this construct enjoy empirical support. More innovative voice e-mail users, for instance, are more capable of utilizing the technology's ability to provide and obtain useful information in an organizational setting (Rice & Shook, 1990). Similarly, greater innovative thinking ability and perception of relative advantage of computer technology are predictive of personal computer adoption decisions (Dickerson & Gentry, 1983).

Individual innovative attributes alone are not sufficient for activating an act of adoption unless the individual is properly motivated to adopt. Midgley and Dowling (1978) contended that an innovative individual with strong novelty-seeking tendencies may either develop and maintain a novelty-seeking orientation (or likelihood to adopt) or develop and then actualize such an orientation (via engaging in actual adoption). This distinction between orientation and actualization is further explicated in Lin's (1998) "need for innovativeness" construct, an indicator of individuals' need to satisfy their novelty-seeking drive as a means for self-actualization via personal computer adoption. Similarly, individuals' need for innovativeness was also found to be a positive predictor of their Internet-use level (Busselle, Reagan, Pinkleton, & Jackson, 1999).

Whereas personality attributes are inherent to adopter receptivity to innovations, and the need for innovativeness helps motivate adoption actions, one's self-confidence in evaluating technology innovations also influences adoption decisions. Bandura (1983) maintained, for instance, that perceived self-efficacy is associated with how people make judgments concerning the applicability of their perceived abilities to confront situations deriving from various circumstances. By implication, individuals with higher self-efficacy will also be more confident in making an adoption decision and less deterred by any number of potential barriers (e.g., complexity involved in mastering the technical skills needed to operate the technology). This assumption was supported when individuals with greater perceived self-efficacy in computer use were found to be more willing to learn and master a computer system (Compeau & Higgins, 1995).

Personality traits of innovativeness need and self-efficacy notwithstanding, when individuals' favorable predispositions about innovation adoption are consistent with their attitude, an actual act of adoption is likely to follow. This assumption flows from the theory of reasoned action (Fishbein, 1980), which suggests that individuals' judgments on whether to take an action is a result of their beliefs about the outcomes of that action and attitudes about those outcomes. Individuals who believe that adoption and use of a technology would be costly and labor intensive may still adopt it if they perceive positive values associated with such adoption as desirable (Fishbein & Ajzen, 1975, 1981). Testing this theory of reasoned action with a "technology acceptance model," Davis (1986, 1989) found support for the positive relationship between one's beliefs and attitudes about innovation adoption. This predictive link between behavioral intention and actual technology adoption has also been established in other empirical studies (e.g., Anandarajan, Simmers, & Igbaria, 2000; Davis, Bagozzi, & Warshaw, 1989; Sheppard, Hartwick, & Warshaw, 1988; Taylor & Todd, 1995).

Social Factors

The audience factors (or adoption predispositions) that influence audience perception of the role and functions of a technology innovation in a social or an organizational setting can also be shaped by a set of socialization factors. Conceptualized as social factors, these cases of socio-environmental mediation can stem from such social structural sources as opinion leaders in a social or organizational setting and the availability of a critical mass of adopters, which enables a sufficient level of communication applications associated with technology use. Such mediation can also be generated by other factors that, on the main, reflect how the social symbolic meanings attached to a medium by the audience influence the perceived effectiveness of social interaction between the mediated communication participants.

One of the key social actors influencing the adoption decision—in either a social group or organization—is the opinion leader, whose topic-specific opinions are often followed. Lazarsfeld, Berelson, and Gaudet's (1944) original notion of opinion leadership explained how opinion leaders filter media messages and pass them on to others, a process that can play a decisive role in determining whether innovations are adopted by opinion followers (Rogers, 1995). In the present context, opinion leaders are usually more innovative and knowledgeable about technology adoption than their followers.

In practice, an opinion leader could be a salient other (e.g., Fulk, 1993), an administrative leader (e.g., Schmitz & Fulk, 1991), a peer or a colleague (e.g., Leonard-Barton & Deschamps, 1988), lead users (Hippel, 1994), or a key communicator (Rogers, 1988). Lead users are typically those organizations or experts within organizations that can foresee the technology needs in advance and adopt innovations to meet those needs before others do so.

Key communicators are typically those individuals who are in a position to exchange information with a diverse set of people within or outside of their immediate social group or organizational setting. By virtue of controlling a large amount of information flow through these frequent exchanges, these key communicators can emerge as influential opinion leaders in technology adoption (Friedkin, 1982; Marsden, 1981), especially when they also occupy administrative leadership positions. Opinion leaders can thus infuse strong "social influences"—through either formal or informal communication channels—over their opinion followers' cognitive, affective, and behavioral orientations toward technology (e.g., Fulk, 1993; Leonard-Barton & Deschamps, 1988; Rice, 1993; Schmitz & Fulk, 1991).

Trevino, Lengel, and Daft (1987) suggested that, if the adoption of a communication medium conveys a particular symbolic gesture and embodies an explicit message itself, then the medium can become a part of the message. When this occurs, the use of the medium is open to social symbolic interpretation. Sitkin, Sutcliffe, and Barrios-Choplin (1992) also considered media choice as carrying both task-relevant content and symbolic meanings. They noted that different media have varying capabilities for conveying verbal and/or nonverbal cues and can also bear divergent symbolic meanings (e.g., valued/devalued, personal/impersonal, powerful/powerless).

The presence of "personal involvement" via human speech, for instance, affords a personalized voice-mail message a greater sense of urgency and social intimacy than an e-mail message with the same content. E-mail adoption choice, in turn, can be a result of how casual or informal the communication is intended to be (Webster & Trevino, 1995).

Individual adoption of a given communication medium can be loaded with a set of symbolic meanings, in particular, those that convey interpersonal distance and relationships to define the nature of a given social discourse.

Moving beyond the different social influences discussed above, there remains a crucial social factor that also can capture the social nature of mediated communication. Oliver, Marwell, and Teixeira's (1985) critical mass theory, as adapted by Marcus (1987), suggests that when universal access to a communication technology is made available, the public good nature of that technology can be fully realized. As logic would dictate, later adopters of an interactive technology can make more efficient use of the technology because there is a much larger number of users available for two-way communication. Early desktop computer conferencing adopters, for instance, had few counterparts with whom to correspond. Late adopters, by comparison, enjoy a critical mass of correspondents who help maximize the cost efficiency of their desktop conferencing technology use. Reaching the level of a critical mass of fax, voice-mail, and e-mail adopters thus influences the subsequent diffusion rate, use patterns, and audience evaluation of these different technologies (Soe & Marcus, 1993). This type of interdependency relationship is also observed by resource dependency theory, which suggests that organizations that depend on others for resources may be obligated to adopt new innovations. Powell (1990), for example, suggested that the communication network involving an organization's suppliers and clients can influence the firm's communication technology adoption.

Hence, whether it occurs at a dyadic or organizational level, amassing a critical mass of adopters is vital to the sustained diffusion of a technology. This dynamic is especially critical at an organizational level, as the "community" acceptance of an interactive technology determines whether a technology succeeds or fails.

Technology Factors

Both the audience and social factors can influence audience beliefs and attitudes toward assessing the technical attributes of a technology. The audience normally develops a set of perceptions and expectations about a technology innovation, often vicariously through social learning (Bandura, 1986), based on a set of objective and subjective criteria. These objective criteria can include the audience's comprehension of a technology's technical characteristics (e.g., transmission speed) and versatility level in terms of its transmutability from one communication modality into another to perform multitasking (e.g., execute multiple audiovisual tasks simultaneously). By contrast, the subjective criteria are often the result of the audience's value-laden assessment of the technology's "personalities" (e.g., ease of use, usefulness) and capability

in communicating social proximity and isomorphism. Rogers (1995) proposed five perceived innovation attribute dimensions: (a) trialability; (b) complexity; (c) relative advantage; (d) compatibility; and (e) observability. These perceived innovation attributes, blending both objective and subjective criteria, also reflect the perceived "prescribed" product attributes to varying degrees by many institutional and individual adopters.

Yet even when objective technology attributes are positive by nature, they can still be negatively perceived by potential adopters. Such audience perceptions about technology attributes can thus formulate "subjective technology characteristics" that impact future adoption decisions (e.g., Agarwal & Prasad, 1997; Rogers, 1995). According to Rice (1987), there are four categories of characteristics that a user may consider when evaluating a communication technology: (a) constraints (or physical character limits); (b) bandwidth (or diversity of communication cues); (c) interactivity (or exchangeability of sources and receivers); and (d) network factors (or facilitation of information flow for groups). Based on this typology, constraints and network factor attributes may reflect the objective characteristics of technology factors, whereas bandwidth and interactivity may represent the subjective characteristics.

One subjective factor considered influential in technology adoption involves the question of how users perceive the ability of a medium to emulate a face-to-face interpersonal communication experience. Mediated communication, as conceptualized by Short, Williams, and Christie (1976), relates to audience involvement along a "social presence" continuum; here the medium can help create different levels of awareness or "presence" (a.k.a., immersiveness) for the participants in their communication interaction. When a business meeting involving participants from different geographic locations is involved, for instance, a real-time, full motion, two-way videoconference commands a higher social presence than an audio conference. The social realism of communication processes can be facilitated, therefore, by the selection of a medium that elicits the desired level of social interaction for a given communication task (Rice, Grant, Schmitz, & Torobin, 1990). In other words, the audience's motivations or intentions to inject a social setting in mediated communication can help determine the technologies selected for adoption.

A related perceived technology dimension that also factors into technology adoption involves the concept of task equivocality. Researchers (Daft & Lengel, 1984) maintain that different mediated communication channels are equipped with different capabilities for processing equivocal information to achieve isomorphism. As their names imply, rich media exhibit the greatest capacity to communicate shared meanings,

whereas lean media have the least such capacity. In particular, level of media richness can be evaluated by such criteria as whether a communication technology allows for (a) the use of natural language; (b) a personal focus; (c) an instant feedback mechanism; and (d) the transmission of multiple cues (e.g., body language, voice inflection).

The telephone, for example, is placed higher on the media richness hierarchy than e-mail, because it has the ability to communicate such nonverbal cues as voice inflection. In that vein, when the communication of unequivocal information is essential, particularly in an organizational setting—perceived richness of different communication channels can be a crucial consideration in adoption decision making. The communication technologies that are perceived as richer media are also seen as preferable choices for carrying out more different types of unequivocal communication tasks (Rice, D'Ambra, & More, 1998; Schmitz & Fulk, 1991).

In comparative terms, social presence theory emphasizes the degree of physical "realism" in mediated social interaction, and media richness theory focuses on the degree of verbal and nonverbal information exchanged. The theory of technology fluidity (Lin, 2000) expands these two concepts by looking at how the transmutability of a medium influences the audience's technology adoption decision. This theory posits that, when the technical attributes of a medium possess a greater capability to transmogrify between or simultaneously operate in multiple communication modalities or task platforms, the technology is a more fluid communication medium. A more fluid communication technology, then, provides not only multitasking functions, but a greater degree of presence of and virtual verbal/nonverbal interactions between communicators. The fluidity of a medium may also directly influence audience perceptions of media richness, as the medium's ability to concurrently deliver the communication content in multiple textual and audiovisual modes should enhance the audience perception of "information richness."

For example, when a user accesses the Web, a site may allow him/her to conduct the following communication tasks simultaneously—"talk" in real time; exchange and edit (or review) faxes, data, graphics, photos, audio files and video files (including live images of the users); play interactive video games, and so forth. Lin's (2000) initial empirical study provides support for this fluidity theory in that the audiences who consider the Internet a more highly fluid medium are also more likely to adopt online broadcasting service via video-streaming technology. The concept of "technology fluidity" also reflects the reality of continuing media and information technology convergence that is creating an array of hybrid multipurpose-multimedia products.

Further examples of fluid technologies include a desktop videoconferencing system that can provide audio, video, text, and computa-

tional displays and exchanges, or a digital personal communication system (PCS) that can serve as a wireless phone, a miniature personal computer, a pager, a video-game player, and a global positioning system (GPS) device. A study of desktop videoconferencing use (Ramsay, Barabesi, & Preece, 1996) found that the system's multimedia modalities are used to set up shared space (e.g., text editors or drawings) for maintaining a shared record (of the communication transaction). Users often do this while engaging in other communication activities (e.g., talking, annotating). Although these preliminary results illustrate the communication benefits derived from technology fluidity, more work is needed to establish the practical and theoretical meaning of this ascendant theory.

Adoption Factors

The several antecedent variables reviewed above—encompassing system, audience, social, and technology factors—can all help to explicate the outcome of the audience's technology adoption decision. The first outcome is nonadoption, by which the audience opts not to adopt the technology. Several studies reported that these antecedent factors are indeed negative predictors or correlates of nonadoption decisions (e.g., Agarwal & Prasad, 1997; Compeau & Higgins, 1995; Davis, Bagozzi, & Warshaw, 1989; Fulk, Schmitz, & Steinfield, 1990; Markus, 1987; Rogers, 1995).

A parallel alternative of nonadoption is discontinuance, in which the audience phases out an adoption and considers adopting a different technology as a replacement. Likewise, with a discontinuance decision (Rogers, 1995), the negative relationships between the antecedent factors that help arrive at a nonadoption decision are also indicative of why a technology adoption is discontinued and whether an alternative technology adoption is being considered as a potential replacement (Kraut, Rice, Cool, & Fish, 1998).

By contrast, the third outcome, likely adoption, portrays the situation in which the audience decides to delay their adoption decision because of certain external and internal adoption barriers. Although these external barriers could be financial resource problems or perceived technology complexity and advantages, internal barriers such as "innovativeness need" could play an even more significant role in deterring the eventual adoption action (Lin, 1998).

Alternatively, the fourth outcome can be an actual adoption act. Once a technology innovation is adopted, the audience may or may not utilize the technology for its originally intended purposes. The prescribed technical functions of the adopted technology can be altered during the implementation state, as determined by use patterns and experiences (Rogers, 1995). Technology implementation can progress through several phases, including (a) adapting the technology to make it compatible with exist-

ing systems or user needs; (b) phasing the technology into appropriate applications over time; and (c) incorporating the technology into a part of users' institutionalized or elemental use routine (Agarwal & Prasad, 1997; Rogers, 1995).

A fifth and related outcome to technology adoption is called "reinvention" (Johnson & Rice, 1987). An example for reinvention could be that e-mail is being used as a survey tool that can gather and transfer survey research data for immediate analysis purposes even though the e-mail system is not designed or adopted to conduct survey research. The activity of reinvention should perhaps be conceptually distinguished from the activity of "adaptation," as each is uniquely applicable in its special circumstances. Specifically, reinvention usually takes place when new uses of a technology are made available through purposefully engineered functional (via adding or changing software, hardware, or peripheral devices) or application modification (via a new or unintended application; e.g., Johnson & Rice, 1987). For instance, the Internet's fluid nature is in part a result of evolving technology reinventions. In particular, experts and amateur users are continually finding new ways to maximize the utilities of the software and hardware platforms and network structures, building on an existing distributed network plant design. By comparison, primary activities for adaptation are usually bound to technical modifications that are generated to successfully implement the adopted technology in the existing technology platform or application infrastructure.

Use Factors

Once the technology adoption decision is implemented, whether used in its original adapted or reinvented form, the cumulative use experience will be subject to audience evaluation from several different perspectives. This cumulative use experience, referred to as "use factors," can reflect a range of responses including (a) whether the expected reward associated with the technology's use is realized; (b) the gratifications received through such use; (c) the perceived ability to control the use experience; and (d) the user attention and interest generated by the use experience.

Trevino and Webster (1992) suggested that perceived communication flow—that is, perceived sense of control, attentiveness, curiosity, and interestedness as experienced through their interaction with the technology—can influence how the audience evaluates a technology. Their findings indicated that sample respondents perceived greater communication flow with the use of email than voice mail, and that perception is also correlated with a positive attitude toward the e-mail technology and the perceived effectiveness and efficiency of their use experience.

This favorable perception and attitude, nevertheless, can be altered by preexisting expectations if the use experience fails to meet those predispositions. Rosenberg's (1956) expectancy-value model asserts that attitude is "accompanied by a cognitive structure made up of beliefs about the potentialities of that object for attaining or blocking the realization of valued states" (p. 367). Based on this theory, if the audience believes that the adopted technology can meet their expectations for improving their communication efficiency (e.g., saving time or money, or increasing productivity) and avoiding potential negatives (e.g., frequent system breakage or technical difficulties), then the audience will develop a positive attitude toward the technology (LaRose & Atkin, 1991).

Even though a positive attitude toward the adopted technology is dependent on the audience's expectancy values, it can be further mediated by the audience's gratification with their technology use experience. Maslow's (1943, 1970) theory of hierarchy of needs postulates that self-actualization needs can motivate the audience to seek the fulfillment of their cognitive and affective needs, such as surveillance (of one's environment), entertainment, diversion, personal identity, through media content use (Blumler, 1979). This theory's ability to explain audience motives for media content choices and use patterns has long been established. In recent years, mediated communication technology adoption has also been substantiated by initial research findings, as predicted by the same theoretical framework.

For instance, Lin (2001) found statistically strong and significant predictive links between different dimensions of audience needs for gratification and the likely adoption of differential online service types. Other empirical studies similarly have reported statistically significant correlational or predictive relationships between audience gratification-seeking motives and the adoption and uses of different aspects of interactive communication media. These include interactive cable systems (Lin & Jeffres, 1998), personal computers (e.g., Perse & Dunn, 1998), electronic bulletin boards (James, Worting, & Forrest, 1995), electronic commerce (Eighmey, 1997), commercial webpage usage (Korgaonkar & Wolin, 1999), and Internet use intentions (Jeffres & Atkin, 1996).

The overall outcomes of these use factors will then translate into a feedback mechanism for the system. Specifically, this mechanism will reinforce, reconfigure, or alter a set of audience predispositions (audience factors) and technology socialization (social factors) that can directly impact how the audience evaluates the technology's attributes (technology factors). These reinforced, reconfigured, or altered audience, social, and technology factors, along with use factors, will also loop back to help shape or reshape future adoption decisions (adoption factors).

The market dynamics generated by the interactions of the different adoption factors, including nonadoption, discontinuance, likely adoption, adoption, and reinvention, then provide feedback to the social system that produces the technology product.

Research Propositions

The research model proposed here has illustrated the complexity of studying the relationships between technology adoption uses and their impact on social systems and the social system's control over technology diffusion. From a systems perspective, due to a lack of valid, reliable, and definable theories or theoretical models, regulation/policy research analysis tends to be ad hoc in nature (e.g., McCool, 1995). This is evidenced by a number of failed public and private policies that stifled the diffusion of new technologies (e.g., digital broadcasting). Good theory building in this area perhaps starts with constructing a research paradigm that allows for the empirical testing of the different system factors inherent to the social system itself. Utilizing the system components presented in the proposed model, the following sample propositions offer a suggested research direction:

Proposition 1: The restrictiveness in regulations and policies is predictive of adoption tendencies.

Proposition 2: The openness in a technological culture is predictive of adoption tendencies.

Proposition 3: The diversity in industry trends is predictive of adoption tendencies.

Proposition 4: The intensity in market competition is predictive of adoption tendencies.

As evidenced by the micro nature of the social factors previously discussed, there may be a strong need to study the social aspects of information technology adoption and uses in which these adoption and use activities take place. The Internet offers a fitting subject for this type of research, as its technical nature permits the audience to use it as an interpersonal, organizational, and mass communication medium. In essence, the Internet's fluid nature makes it an excellent choice to study, for instance, social support groups that utilize the point-to-point modality to provide group support (Walther & Boyd, 2002) and the single-to-multiple point modality to share relevant media information content online. It seems that we yet need to fully understand what makes a communication technology a social medium and what role that social medium plays in shaping the technological culture in a social system. The following propositions offer an example

of how the social factors included in the proposed model may be empirically tested:

Proposition 5: The strength of opinion leadership is predictive of adoption tendencies.

Proposition 6: The speed of reaching a critical mass is predictive of adoption tendencies.

Proposition 7: The significance of media symbolism is predictive of adoption tendencies.

When assessing audience factors, the key remains maintaining a focus on the audience's cognitive, affective, and behavioral dispositions and intentions. Empirical studies should strive to establish a set of indexes or scales based on self-efficacy theory and the theory of reasoned action that can be applied to the study of various information technologies. In addition, audience characteristics that are relevant to their innovative nature, such as innovative attributes, innovativeness needs, and perceived external resources (i.e., perceived economic means), should be the primary demographic/psychographic variables of interest. The significance of allowing these innovation-relevant internal personality traits to take precedence over certain conventional demographic and psychographic indicators (e.g., education, gender, or hobbies) is already manifest, due to declining technology costs and a rapidly growing "technological culture" influencing the entire social spectrum. The propositions presented below demonstrate how the audience factors contained in the proposed model may guide further research:

Proposition 8: Audience innovative attributes are predictive of adoption tendencies.

Proposition 9: Audience innovativeness need is predictive of adoption tendencies.

Proposition 10: Audience technology self-efficacy is predictive of adoption tendencies.

Proposition 11: Belief and attitude about a technology are predictive of adoption tendencies.

As technological culture progresses, the audience may also accept the ubiquitous "invasion" of technology products as a necessary evil and perceive them as "technology appliances" (e.g., personal computers). The innovation attributes relevant to audience adoption decisions then may involve the more subjective "personality" criteria, such as perceived ease of use, usefulness (e.g., Igbaria, Schiffman, & Wieckowski, 1994), advantages (or benefits; Lin, 1998), and technology fluidity (Lin, 2000). Whereas the advancements in multifunctional-multipurpose multitasking communication technologies continue, perceived technology fluidity may also emerge as an important innovation attribute. Future research exploration of the validity and reliability of the theory of technology fluidity should help enhance our understanding of how the audience relates to these multitasking media. The following propositions show how the

technology factors described in the proposed model may be applied in empirical research:

Proposition 12: Perceived technology innovation attributes are predictive of adoption tendencies.

Proposition 13: Perceived technology social presence is predictive of adoption tendencies.

Proposition 14: Perceived technology media richness is predictive of adoption tendencies.

Proposition 15: Perceived technology fluidity is predictive of adoption tendencies.

Turning to the adoption factors, the most obvious areas of research needed appear to be the concepts of "likely adoption" (Lin, 1998) and reinvention (e.g., Johnson & Rice, 1987; Rogers, 1995). Because likely adopters are the next immediate wave of adopters for a technology, reinventing technical applications of a technology can be instrumental in lengthening its life span and retaining existing adopters. These two concepts, as elements of the adoption factors, can be generalized and deducted empirically as follows:

Proposition 16: Likely adopters' external/internal barriers are predictive of adoption tendencies.

Proposition 17: The frequency of technology reinvention is predictive of adoption tendencies.

Finally, use factors are the primary source for providing system feedback. The communication flow construct (Trevino & Webster, 1992) may be a promising approach to examine user cognitive involvement with the technology use experience. Although the uses and gratifications perspective has received more notice as a valid means of measuring audience cognitive and affective fulfillment via technology use, refinement in content as well as construct validity is much needed in empirical studies. Likewise, Rosenberg's (1956) expectancy value theory, an extension of the theory of reasoned action, offers a well-grounded foundation for studying how positive belief leads to positive attitude and ultimately adoption action. Yet, this theory is waiting to be "rediscovered," as it was once validated by earlier studies addressing media content choice (e.g., Galloway & Meek, 1981) and medium choice (LaRose & Atkin, 1991). To further explore the potential explanatory power of these theories as components of the use factors in the proposed model, three propositions are presented below:

Proposition 18: Perceived user gratification is predictive of adoption tendencies.

Proposition 19: Perceived user expectancy is predictive of adoption tendencies.

Proposition 20: Perceived communication flow is predictive of adoption tendencies.

Conclusion

The research model discussed herein integrates its various components into a coherent set of interrelated constructs. As each model component is linked to at least a theoretical tradition or an established theory, the model can be easily tested empirically as demonstrated by the sample list of proposed propositions. Most importantly, the interrelations between model components can also be examined with the application of these well-recognized theoretical frameworks. As this research model presents a basis for empirical endeavors, the ultimate objective remains to theorize and to explain mediated communication as a social process.

For this very reason, it is vital for communication/information technology research to take an interdisciplinary as well as an integrated approach. McQuail's (1987) list of bipolar dimensions, ascribing the potential evaluative criteria for what technologies may bestow upon a "wired city," may serve as a good road map for communication researchers. These evaluative dimensions include more communication or less, freedom versus control, diversity versus uniformity access exclusion, interaction versus one-way communication, equality-inequality, centralization versus decentralization, and privatization or enlargement of the public sphere. In conclusion, the values of communication/information technology adoption research are immeasurable in that they reflect our desire to have control over technology and our ability to communicate, and henceforth the destiny of our humanity.

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